

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of claims:

1-200. (cancelled)

201. (new) An active filter comprising:

– a first stage (10) provided with:

· a first operational amplifier (11) having an inverting input (11a), a noninverting input (11b) and an output (11c);

· a resistor (12) having a first end (12a) connected with the inverting input (11a) of said first operational amplifier (11) and a second end (12b) set to receive an input signal (V_s);

· a second resistor (13) having a first end (13a) connected to the inverting input (11a) of said first operational amplifier (11) and a second end (13b) connected with the output (11c) of said first operational amplifier (11);

– a second stage (20) provided with:

· a second operational amplifier (21), having an inverting input (21a), a noninverting input (21b) and an output (21c);

· a resistor (22) having a first end (22a) connected with the inverting input (21a) of said second operational amplifier (21) and a second end (22b) connected to the output (11c) of said first operational amplifier (11);

- feedback means (23) having a first end (23a) connected to the inverting input (21a) of said second operational amplifier (21) and a second end (23b) connected to the output (21c) of said second operational amplifier (21);
- a third stage (30) provided with:
 - a third operational amplifier (31) having an inverting input (31a), a noninverting input (31b) and an output (31c);
 - a resistor (32) having a first end (32a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (32b) connected to the output (21c) of said second operational amplifier (21);
 - feedback means (33) having a first end (33a) connected to the inverting input (31a) of said third operational amplifier (31), and a second end (33b) connected to the output (31c) of said third operational amplifier (31);
 - a main feedback branch (50) defined by a resistor (51) and having a first end (50a) connected to the output (31c) of said third operational amplifier (31), and a second end (50b) connected to the inverting input (11a) of said first operational amplifier (11),
- further comprising a fourth stage (40) provided with:
 - a fourth operational amplifier (41) having an inverting input (41a), a noninverting input (41b) and an output (41c), said inverting input (41a) being connected to the noninverting input (11b, 21b or 31b) of one of said first, second and third operational amplifiers (11, 21, 31), either directly or through a resistor;
 - a first resistor (42) having a first end (42a) connected to the inverting input (41a) of said fourth operational amplifier (41) and a second end (42b);

– a second resistor (43) having a first end (43a) connected to the inverting input (41a) of said fourth operational amplifier (41) and a second end (43b) connected to the output (41c) of said fourth operational amplifier (41).

202. (new) A filter as claimed in claim 201, wherein the feedback means (23) of said second stage (20) is defined by a branch comprising a capacitor and a resistor connected to each other in series, this branch being parallel-connected to a capacitor.

203. (new) A filter as claimed in claim 201, wherein the second end (42b) of the first resistor (42) of said fourth stage (40) is connected to the output (11c) of said first operational amplifier (11).

204. (new) A filter as claimed in claim 203, wherein the inverting input (31a) of said third operational amplifier (31) is directly connected to the noninverting input (41b) of said fourth operational amplifier (41), the inverting input (41a) of said fourth operational amplifier (41) being connected to the noninverting input (11b) of said first operational amplifier (11), either directly or through a resistor.

205. (new) A filter as claimed in claim 204, further comprising a feedback resistor (106) having a first end (106a) connected to the output (21c) of said second operational amplifier (21), and a second end (106b) connected to the noninverting input (11b) of said first operational amplifier (11).

206. (new) A filter as claimed in claim 203, wherein the noninverting input (41b) of said fourth operational amplifier (41) is directly connected to the inverting input (21a) of said second operational amplifier (21), the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (11b) of said first operational amplifier (11), a direct connection (203) being between the inverting input (11a) of said first operational amplifier (11) and the noninverting input (31b) of said third operational amplifier (31).

207. (new) A filter as claimed in claim 206, further comprising an auxiliary resistor (61) connected between the inverting input (31a) of said third operational amplifier (31) and a fixed-potential node.

208. (new) An active filter comprising:

– a first stage (10) provided with:

- a first operational amplifier (11) having an inverting input (11a), a noninverting input (11b) and an output (11c);
- a resistor (12) having a first end (12a) connected with the inverting input (11a) of said first operational amplifier (11) and a second end (12b) set to receive an input signal (V_s);
- feedback means (13) having a first end (13a) connected to the inverting input (11a) of said first operational amplifier (11) and a second end (13b) connected with the output (11c) of said first operational amplifier (11);

– a second stage (20) provided with:

- a second operational amplifier (21), having an inverting input (21a), a noninverting input (21b) and an output (21c);

- a resistor (22) having a first end (22a) connected with the inverting input (21a) of said second operational amplifier (21) and a second end (22b) connected to the output (11c) of said first operational amplifier (11);
- feedback means (23) having a first end (23a) connected to the inverting input (21a) of said second operational amplifier (21) and a second end (23b) connected to the output (21c) of said second operational amplifier (21);
- a third stage (30) provided with:
 - a third operational amplifier (31) having an inverting input (31a), a noninverting input (31b) and an output (31c);
 - a first resistor (32) having a first end (32a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (32b) connected to the output (21c) of said second operational amplifier (21);
 - a second resistor (33) having a first end (33a) connected to the inverting input (31a) of said third operational amplifier (31), and a second end (33b) connected to the output (31c) of said third operational amplifier (31);
 - a main feedback branch (50) defined by a resistor (51) and having a first end (50a) connected to the output (31c) of said third operational amplifier (31), and a second end (50b) connected to the inverting input (11a) of said first operational amplifier (11),
- further comprising a fourth stage (40) provided with:
 - a fourth operational amplifier (41) having an inverting input (41a), a noninverting input (41b) and an output (41c), said inverting input (41a) being directly connected either to the noninverting input (11b) of said first operational amplifier (11) or to the noninverting input (31b) of said third operational amplifier (31);

- a first resistor (42) having a first end (42a) connected to the inverting input (41a) of said fourth operational amplifier (41), and a second end (42b) connected to the output (11c) of said first operational amplifier (11);
- a second resistor (43) having a first end (43a) connected to the inverting input (41a) of said fourth operational amplifier (41), and a second end (43b) connected to the output (41c) of said fourth operational amplifier (41).

209. (new) A filter as claimed in claim 208, wherein the inverting input (31a) of said third operational amplifier (31) is directly connected to the noninverting input (41b) of said fourth operational amplifier (41), a direct connection (201) being between the inverting input (31a) of said third operational amplifier (31) and the noninverting input (21b) of said second operational amplifier (21), the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (11b) of said first operational amplifier (11).

210. (new) A filter as claimed in claim 209, further comprising a main resistor (60) connected between the inverting input (11a) of said first operational amplifier (11) and a fixed-potential node.

211. (new) An active filter comprising:

- a first stage (10) provided with:
 - a first operational amplifier (11) having an inverting input (11a), a noninverting input (11b) and an output (11c);

- a resistor (12) having a first end (12a) connected with the inverting input (11a) of said first operational amplifier (11) and a second end (12b) set to receive an input signal (V_s);
- feedback means (13) having a first end (13a) connected to the inverting input (11a) of said first operational amplifier (11) and a second end (13b) connected with the output (11c) of said first operational amplifier (11);
- a second stage (20) provided with:
 - a second operational amplifier (21), having an inverting input (21a), a noninverting input (21b) and an output (21c);
 - a first resistor (22) having a first end (22a) connected with the inverting input (21a) of said second operational amplifier (21) and a second end (22b) connected to the output (11c) of said first operational amplifier (11);
 - a second resistor (23) having a first end (23a) connected to the inverting input (21a) of said second operational amplifier (21) and a second end (23b) connected to the output (21c) of said second operational amplifier (21);
- a third stage (30) provided with:
 - a third operational amplifier (31) having an inverting input (31a), a noninverting input (31b) and an output (31c);
 - a resistor (32) having a first end (32a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (32b) connected to the output (21c) of said second operational amplifier (21);
 - feedback means (33) having a first end (33a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (33b) connected to the output (31c) of said third operational amplifier (31);

– a main feedback branch (50) defined by a resistor (51) and having a first end (50a) connected to the output (31c) of said third operational amplifier (31), and a second end (50b) connected to the inverting input (11a) of said first operational amplifier (11),

further comprising a fourth stage (40) provided with:

– a fourth operational amplifier (41) having an inverting input (41a), a noninverting input (41b) and an output (41c), said inverting input (41a) being directly connected with the noninverting input (11b) of said first operational amplifier (11) or the noninverting input (21b) of said second operational amplifier (21);

– a first resistor (42) having a first end (42a) connected to the inverting input (41a) of said fourth operational amplifier (41) and a second end (42b) connected to the output (21c) of said second operational amplifier (21);

– a second resistor (43) having a first end (43a) connected to the inverting input (41a) of said fourth operational amplifier (41) and a second end (43b) connected to the output (41c) of said fourth operational amplifier (41).

212. (new) A filter as claimed in claim 211, further comprising a main resistor (60) having a first end (60a) connected to the inverting input (11a) of said first operational amplifier (11) and a second end (60b) connected to a fixed-potential node.

213. (new) A filter as claimed in claim 211, further comprising a direct connection (81) between the inverting input (31a) of said third operational amplifier (31) and the noninverting input (11b) of said first operational amplifier

(11), the noninverting input (41b) of said fourth operational amplifier (41) being connected to a fixed-potential node, the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (21b) of said second operational amplifier (21).

214. (new) A filter as claimed in claim 211, further comprising a direct connection (82) between the inverting input (11a) of said first operational amplifier (11) and the noninverting input (41b) of said fourth operational amplifier (41), the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (21b) of said second operational amplifier (21).

215. (new) A filter as claimed in claim 211, further comprising a direct connection (84) between the inverting input (31a) of said third operational amplifier (31) and the noninverting input (41b) of said fourth operational amplifier (41).

216. (new) A filter as claimed in claim 212, further comprising a direct connection (84) between the inverting input (31a) of said third operational amplifier (31) and the noninverting input (41b) of said fourth operational amplifier (41).

217. (new) A filter as claimed in claim 215, further comprising a direct connection (85) between the inverting input (11a) of said first operational amplifier (11) and the noninverting input (21b) of said second operational

amplifier (21), the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (11b) of said first operational amplifier (11).

218. (new) A filter as claimed in claim 215, further comprising a direct connection (87) between the inverting input (21a) of said second operational amplifier (21) and the noninverting input (11b) of said first operational amplifier (11), the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (21b) of said second operational amplifier (21).

219. (new) An active filter comprising:

– a first stage (10) provided with:

- a first operational amplifier (11) having an inverting input (11a), a noninverting input (11b) and an output (11c);
- feedback means (13) having a first end (13a) connected to the inverting input (11a) of said first operational amplifier (11) and a second end (13b) connected to the output (11c) of said first operational amplifier (11);
- a resistor (12) having a first end (12a) connected to the inverting input (11a) of said first operational amplifier (11) and a second end (12b) set to receive an input signal (V_s);

– a second stage (20) provided with:

- a second operational amplifier (21), having an inverting input (21a), a noninverting input (21b) and an output (21c);

- feedback means (23) having a first end (23a) connected to the inverting input (21a) of said second operational amplifier (21) and a second end (23b) connected to the output (21c) of said second operational amplifier (21);
- a resistor (22) having a first end (22a) connected with the inverting input (21a) of said second operational amplifier (21) and a second end (22b) connected to the output (11c) of said first operational amplifier (11);
- a third stage (30) provided with:
 - a third operational amplifier (31) having an inverting input (31a), a noninverting input (31b) and an output (31c);
 - a first resistor (32) having a first end (32a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (32b) connected to the output (21c) of said second operational amplifier (21);
 - a second resistor (33) having a first end (33a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (33b) connected to the output (31c) of said third operational amplifier (31);
 - a main feedback branch (50) defined by a resistor (51) and having a first end (50a) connected to the output (31c) of said third operational amplifier (31) and a second end (50b) connected to the inverting input (11a) of said first operational amplifier (11),
- further comprising a fourth stage (40) provided with:
 - a fourth operational amplifier (41) having an inverting input (41a), a noninverting input (41b) and an output (41c);
 - a first resistor (42) having a first end (42a) connected to the inverting input (41a) of said fourth operational amplifier (41) and a second end (42b) connected to the output (31c) of said third operational amplifier (31), the inverting input (41a)

of said fourth operational amplifier (41) being directly connected with the noninverting input (21b) of said second operational amplifier (21) or with the noninverting input (31b) of said third operational amplifier (31);

– a second resistor (43) having a first end (43a) connected to the inverting input (41a) of said fourth operational amplifier (41) and a second end (43b) connected to the output (41c) of said fourth operational amplifier (41).

220. (new) A filter as claimed in claim 219, further comprising a direct connection (223) between the inverting input (21a) of said second operational amplifier (21) and the noninverting input (41b) of said fourth operational amplifier (41), the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (31b) of said third operational amplifier (31).

221. (new) An active filter comprising:

– a first stage (10) provided with:

· a first operational amplifier (11) having an inverting input (11a), a noninverting input (11b) and an output (11c);

· a resistor (12) having a first end (12a) connected with the inverting input (11a) of said first operational amplifier (11) and a second end (12b) set to receive an input signal (V_s);

· feedback means (13) having a first end (13a) connected to the inverting input (11a) of said first operational amplifier (11) and a second end (13b) connected with the output (11c) of said first operational amplifier (11);

– a second stage (20) provided with:

- a second operational amplifier (21), having an inverting input (21a), a noninverting input (21b) and an output (21c);
- a first resistor (22) having a first end (22a) connected with the inverting input (21a) of said second operational amplifier (21) and a second end (22b) connected to the output (11c) of said first operational amplifier (11);
- a second resistor (23) having a first end (23a) connected to the inverting input (21a) of said second operational amplifier (21) and a second end (23b) connected to the output (21c) of said second operational amplifier (21);
- a third stage (30) provided with:
 - a third operational amplifier (31) having an inverting input (31a), a noninverting input (31b) and an output (31c);
 - a resistor (32) having a first end (32a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (32b) connected to the output (21c) of said second operational amplifier (21);
 - feedback means (33) having a first end (33a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (33b) connected to the output (31c) of said third operational amplifier (31);
 - a main feedback branch (50) defined by a resistor (51) and having a first end (50a) connected to the output (31c) of said third operational amplifier (31) and a second end (50b) connected to the inverting input (11a) of said first operational amplifier (11),
- characterised in that it further comprises a fourth stage (40) provided with:
 - a fourth operational amplifier (41) having an inverting input (41a) directly connected to the noninverting input (21b) of said second operational amplifier

(21) or the noninverting input (31b) of said third operational amplifier (31), a noninverting input (41b) and an output (41c);

- a first resistor (42) having a first end (42a) connected to the inverting input (41a) of said fourth operational amplifier (41) and a second end (42b) connected to the output (31c) of said third operational amplifier (31);

- a second resistor (43) having a first end (43a) connected to the inverting input (41a) of said fourth operational amplifier (41) and a second end (43b) connected to the output (41c) of said fourth operational amplifier (41).

222. (new) A filter as claimed in claim 221, further comprising a direct connection (77) between the inverting input (31a) of said third operational amplifier (31) and the noninverting input (11b) of said first operational amplifier (11).

223. (new) A filter as claimed in claim 222, wherein the noninverting input (41b) of said fourth operational amplifier (41) is directly connected to the inverting input (21a) of said second operational amplifier (21), said filter further comprising an auxiliary resistor (61) connected between the inverting input (31a) of said third operational amplifier (31) and a fixed-potential node, the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (31b) of said third operational amplifier (31).

224. (new) An active filter comprising:

- a first stage (10) provided with:

- a first operational amplifier (11) having an inverting input (11a), a noninverting input (11b) and an output (11c);
- feedback means (13) having a first end (13a) connected to the inverting input (11a) of said first operational amplifier (11) and a second end (13b) connected to the output (11c) of said first operational amplifier (11);
- a second stage (20) provided with:
 - a second operational amplifier (21), having an inverting input (21a), a noninverting input (21b) and an output (21c);
 - a resistor (22) having a first end (22a) connected to the inverting input (21a) of said second operational amplifier (21) and a second end (22b) connected to the output (11c) of said first operational amplifier (11);
 - feedback means (23) having a first end (23a) connected to the inverting input (21a) of said second operational amplifier (21) and a second end (23b) connected to the output (21c) of said second operational amplifier (21);
- a third stage (30) provided with:
 - a third operational amplifier (31) having an inverting input (31a), a noninverting input (31b) and an output (31c);
 - a resistor (32) having a first end (32a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (32b) connected to the output (21c) of said second operational amplifier (21);
 - feedback means (33) having a first end (33a) connected to the inverting input (31a) of said third operational amplifier (31) and a second end (33b) connected to the output (31c) of said third operational amplifier (31);
- a main feedback branch (50) defined by a resistor (51) and having a first end (50a) connected to the output (31c) of said third operational amplifier (31) and a

second end (50b) connected to the inverting input (11a) of said first operational amplifier (11),

further comprising a first connecting branch having a first end connected to the inverting input (11a, 21a or 31a) of a predetermined one of said first, second and third operational amplifiers (11, 21, 31) and a second end connected to at least one of the two noninverting inputs of the respective ones of said operational amplifiers (11, 21, 31) different from said predetermined operational amplifier (11, 21, 31), at least the noninverting input (11b, 21b or 31b) of the latter being connected, either directly or through a resistor, to a fixed-potential node, said first connecting branch being also defined by a respective fourth stage (40) provided with an amplifier and having an input ("in") connected to the first end of said first connecting branch, and an output ("out") connected to the second end of the same branch either directly or through a respective resistor.

225. (new) A filter as claimed in claim 224, further comprising a second connecting branch having a first end connected to the inverting input (11a, 21a or 31a) of one of said first, second and third operational amplifiers (11, 21, 31) and a second end connected to the noninverting input (11b, 21b or 31b) of another of the same operational amplifiers (11, 21, 31) different from said predetermined operational amplifier (11, 21 or 31), the second end of said first connecting branch being connected to one alone of the two noninverting inputs of the respective ones of said operational amplifiers (11, 21, 31) different from said predetermined operational amplifier.

226. (new) A filter as claimed in claim 225, wherein said second connecting branch is defined by a direct connection or by a respective fourth stage (40) provided with an amplifier and having an input ("in") connected to the first end of said second connecting branch, and an output ("out") connected to the second end of the same branch either directly or through a respective resistor.

227. (new) A filter as claimed in claim 225, wherein said second connecting branch is defined by a respective fourth stage (40) provided with an amplifier and having an input ("in") connected to the first end of said second connecting branch and an output ("out") connected to the second end of the same branch, through a respective resistor, the first end of said second connecting branch being connected to the inverting input of one of said first, second and third operational amplifiers (11, 21, 31) different from said predetermined operational amplifier, the first connecting branch being further defined by said respective fourth stage (40), the output ("out") of the latter being connected to the second end of said first connecting branch through said respective resistor, the second end of said first connecting branch and the second end of said second connecting branch being also connected to the same noninverting input.

228. (new) A filter as claimed in claim 224, further comprising a resistor (12) having a first end (12a) connected to the inverting input (11a) of said first operational amplifier (11) and a second end (12b) set to receive an input signal (V_s).

229. (new) A filter as claimed in claim 224, further comprising a resistor (12) having a first end (12a) connected to the noninverting input (11b) of said first operational amplifier (11) and a second end (12b) set to receive an input signal (V_s).

230. (new) A filter as claimed in claim 212, further comprising a direct connection (81) between the inverting input (31a) of said third operational amplifier (31) and the noninverting input (11b) of said first operational amplifier (11), the noninverting input (41b) of said fourth operational amplifier (41) being connected to a fixed-potential node, the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (21b) of said second operational amplifier (21).

231. (new) A filter as claimed in claim 216, further comprising a direct connection (87) between the inverting input (21a) of said second operational amplifier (21) and the noninverting input (11b) of said first operational amplifier (11), the inverting input (41a) of said fourth operational amplifier (41) being directly connected to the noninverting input (21b) of said second operational amplifier (21).